

EPA will only consider removals conducted before the SI in the HRS score.

R. Cutoff Score

In the NPRM preamble, EPA proposed that the cutoff score for the revised HRS be functionally equivalent to the current cutoff score of 28.5. The Agency also requested comment on three proposed options for determining functional equivalence:

- Option 1: Score sites using both the original and final rule, then use statistical analysis to determine what revised HRS score best corresponds to 28.5;

- Option 2: Choose a score that would result in an NPL of the same size as the NPL that would be created by using the original HRS; and

- Option 3: Identify the risk level that would correspond to 28.5 in the original HRS and then determine what revised HRS score corresponds to that risk level.

Some commenters stated that there cannot be a functional equivalence if the revisions have any meaning. They argued that if the revisions meet the statutory mandate to make the HRS more accurate, the scores should be different and, therefore, cannot be related. Several commenters supported the use of a functional equivalent, but were divided about which option should be used. One commenter stated that the 28.5 score should be evaluated to determine whether it reflected minimum risk levels. If it did, the commenter suggested that a functional equivalent would be appropriate and should be determined using equivalent risk levels (option 3), but also with an eye toward keeping the NPL to a manageable size (option 2).

Commenters not supporting the use of a functional equivalent suggested a variety of alternative approaches, including:

- Establish the cutoff score based on risk, without regard to the current cutoff level or a functional equivalent;

- Leave the score at 28.5;

- Propose a new cutoff score and a description of methodology in a public notice with a 60-day public comment period;

- Lower the cutoff score to provide an incentive to responsible parties to undertake remedial efforts and make it possible for sites where a removal action has taken place to make the NPL, thus reducing the controversy over whether to score sites based on current conditions;

- Raise the cutoff score by at least 20 points;

- Eliminate the present cutoff score by creating categories of sites instead of

individual ranks as a means of prioritizing NPL sites;

- Amend the NPL annually to include only those sites that deserve priority attention (e.g., orphaned sites) and are likely to receive Superfund financing; or

- Rank all sites showing any degree of public health and/or environmental risk on a relative scale and perform remedial activities based on available funding.

In addition, four commenters felt that the cutoff score for the final rule should not be fixed until the technical merits and potential scores of representative sites are tested and compared using both the current and proposed HRS. Further, one commenter noted that the field test did not indicate the relationship between the revised HRS score for a given site and the current score; another added that until this equivalency issue is clarified, meaningful comment on any proposed revisions cannot be made.

Based on an analysis of 110 test sites, EPA has decided not to change the cutoff score at this time. This conclusion was reached after applying all three approaches to setting a cutoff score that would be functionally equivalent to 28.5. In its analysis, the Agency scored field test sites with both the original and revised HRS. The data from these test sites show that few sites score in the range of 25 to 30 with the revised HRS model. The Agency believes that this range may represent a breakpoint in the distribution of site scores and that the sites scoring above the range of 25-30 are clearly the types of sites that the Agency should capture with a screening model. Because the analysis did not point to a single number as the appropriate cutoff, the Agency has decided to continue to employ 28.5 as a management tool for identifying sites that are candidates for the National Priorities List.

EPA believes that the cutoff score has been, and should continue to be, a mechanism that allows it to make objective decisions on national priorities. Because the HRS is intended to be a screening system, the Agency has never attached significance to the cutoff score as an indicator of a specific level of risk from a site, nor has the Agency intended the cutoff to reflect a point below which no risk was present. The score of 28.5 is not meant to imply that risky and non-risky sites can be precisely distinguished. Nevertheless, the cutoff score has been a useful screening tool that has allowed the Agency to set priorities and to move forward with studying and, where appropriate, cleaning up hazardous

waste sites. The vast majority of sites scoring above 28.5 in the past have been shown to present risks. EPA believes that a cutoff score of 28.5 will continue to serve this crucial function.

IV. Section-by-Section Analysis of Rule Changes

Besides the changes discussed above, EPA has made substantial editorial revisions in the rule being adopted today. Source characterization is discussed in section 2 of the final rule, along with factors that are evaluated in each pathway. These factors include hazardous waste quantity, toxicity, and evaluation of targets based on benchmarks. The order of presentation of the pathways has been changed to ground water, surface water, soil exposure, and air. Following the four sections describing the pathways, a section has been added explaining how to evaluate sites that have radionuclides either as the only hazardous substances at the site or in combination with other hazardous substances.

In general, descriptive text that provided background information has been removed as have references and data sources; the sections have been rewritten to make the rule easier to read and to apply. The figures presenting overviews of the pathways and the scoring sheets have been revised throughout to reflect changes in the rule and assigned values.

This section describes, for each section of the rule and each table, the specific substantive changes; editorial changes that do not affect the content of the rule are not generally noted.

Section 1 Introduction

The text explaining the background of the HRS and describing the rule has been removed. Definitions of a number of additional terms used in the rule have been added for clarity. The definition of "hazardous substance" has been revised for clarification. The definition of "site" has been clarified and now indicates that the area between sources may also be considered part of the site. The definition of "source" has been revised to explain that those volumes of air, ground water, surface water, or surface water sediments that become contaminated by migration of hazardous substances are not considered a source, except contaminated ground water plumes or contaminated surface water sediments may be considered a source if they cannot be attributed to an identified source. In addition, the definition of source now includes soils contaminated by migration of hazardous substances.

Under the original HRS, the Agency took the approach that all feasible efforts should be made to identify sources before listing a site on the NPL. If, after an appropriate effort has failed to identify a source, the Agency believed that the contamination was likely to have originated at the type of source that would be addressed under Superfund, such sites were listed. Subsequent investigations after listing have generally identified a specific source. In some cases, EPA has not listed contaminated media without clearly identified sources because it appeared the source of pollution would not be addressed by Superfund programs; an example of such a source would be extensive, low-level contamination of surface water sediments caused by pesticide applications. EPA has found this approach to be generally workable and will continue to evaluate, on a case-by-case basis, whether sites with no identified sources should be listed.

Where contaminated media with no identified sources exist, the final rule generally assigns a hazardous waste quantity factor value to such contamination, with the value depending on whether there are any targets subject to Level I or Level II concentrations. For contaminated sediments in the surface water migration pathway, if there is a clearly defined direction of flow, target distances are measured from the point of observed sediment contamination that is farthest upstream. For ground water plumes and for contaminated sediments where there is no clear direction of flow, the center of the observed ground water or sediment contamination is used for the purpose of measuring target distance limits.

Section 2 Evaluations Common to Multiple Pathways

This section covers factors and evaluations common to multiple pathways. The major changes to these factors include: observed release criteria have been revised; the toxicity factor has been changed to a linear rather than a log scale; scales for hazardous waste quantity have been made linear and expanded, and the hazardous waste quantity minimum value has been changed; the waste characteristics factor category score is now obtained by multiplying the factor values and using a table to assign the final score; use of benchmarks has been extended to all pathways and to the nearest individual (well/intake) factor; and the methods for comparisons to benchmarks have been changed as have the benchmarks used. The purpose of this part is to make the rule less repetitious by presenting full explanations of the evaluation of certain factors only once rather than in each pathway in which they occur.

Exceptions related to radionuclides are noted throughout the rule and referenced to Section 7.

Section 2.1 Overview. Introduces the pathways and threats included in HRS scoring.

Section 2.1.1 Calculation of HRS site score. Provides the equation used to calculate the final HRS score.

Section 2.1.2 Calculation of pathway score. Indicates, in general, how pathway scores are calculated and includes a sample pathway score sheet (Table 2-1).

Section 2.1.3 Common evaluations. Lists evaluations common to all pathways.

Section 2.2 Characterize sources. Introduces source characterization and references Table 2-2, the new sample source characterization worksheet.

Section 2.2.1 Identify sources. Explains that for the three migration pathways, sources are identified, and for the soil exposure pathway, areas of observed contamination are identified.

Section 2.2.2 Identify hazardous substances associated with a source. Covers information previously provided in the introduction to the waste characteristics factor category.

Section 2.2.3 Identify hazardous substances available to a pathway. Explains which hazardous substances may be considered available to each pathway. For the three migration pathways, the primary limitation on availability of a hazardous substance to a pathway is that the substance must be in a source with a containment factor value, for that pathway, greater than 0; that is, the hazardous substance must be available to migrate from its source to the medium evaluated. For the soil exposure pathway, the primary limitation is that the substance must meet the criteria for observed contamination and, for the nearby threat, it must also be accessible.

Section 2.3 Likelihood of release. Specifies the criteria for establishing an observed release (discussed in section III G of this preamble) and explains that potential to release factors are evaluated only when an observed release cannot be documented. Table 2-3, which replaces Table 2-2 in the proposed rule, provides the revised observed release criteria for chemical analyses for the migration pathways. Table 2-3 is also used in establishing observed contamination for the soil exposure pathway.

Section 2.4 Waste characteristics. Defines the waste characteristics factor category.

Section 2.4.1 Selection of substance potentially posing greatest hazard.

Explains how to select the substance potentially posing the greatest hazard.

Section 2.4.1.1 Toxicity factor. Explains how to assign toxicity values. Changes in the approach to scoring toxicity are discussed in section III D of this preamble. Table 2-4 (proposed rule Table 2-11) has been revised to make the assigned factor values linear rather than logarithmic values; however, the relationship among the values has not changed. A provision to always assign lead (and its compounds) an HRS toxicity factor value of 10,000 was added as a result of changes since the time of the proposed rule in the way EPA develops chronic toxicity values for lead (i.e., reference doses, in units of intake (mg/kg-day), are no longer developed for lead).

Section 2.4.1.2 Hazardous substance selection. Lists which factors are combined, in each pathway or threat, to select the hazardous substance potentially posing the greatest hazard. For each migration pathway, each substance eligible for consideration is evaluated based on the combination of toxicity (human or ecosystem) and/or mobility, persistence, and bioaccumulation (or ecosystem bioaccumulation) potential. The substances selected for each pathway or threat are those with the highest combined values. For the soil exposure pathway, the substance with the highest toxicity value is selected from among substances that meet the criteria for observed contamination for the threat being evaluated. The use of bioaccumulation in the selection of substances in the human food chain threat has changed as a result of the structural changes discussed above. In the proposed rule, only substances with the highest bioaccumulation values were evaluated for toxicity/persistence; in the final rule, the substance with the highest combined toxicity/persistence/bioaccumulation value is selected in the human food chain threat of the overland flow/flood migration component. For the ground water to surface water migration component, mobility is also considered. This revised method better reflects the overall threat.

Section 2.4.2 Hazardous waste quantity. Describes how to calculate the hazardous waste quantity factor value, as explained in section III D of this preamble. The explanation has been simplified from that presented in the proposed rule, and a discussion of unallocated sources has been added. A discussion clarifying the method for evaluating hazardous waste quantity in the soil exposure pathway was also added, and clarifying language on this

point was inserted throughout the subsections of § 2.4.2. Table 2-13 from the proposed rule has been eliminated.

Section 2.4.2.1 Source hazardous waste quantity. Details the measures that may be considered in evaluating hazardous waste quantity for a source or area of observed contamination.

Section 2.4.2.1.1 Hazardous constituent quantity. Explains how to assign a value to the hazardous constituent quantity factor. An explanation of the treatment of RCRA hazardous wastes has been added to clarify the scoring of these wastes. Table 2-5, Hazardous Waste Quantity Evaluation Equations (proposed rule Table 2-14), has been revised in several ways. The constant divisor of 10 has been moved from these equations and is now incorporated into the factor values assigned using Table 2-6. Two types of surface impoundments are now listed to ensure that buried surface impoundments are treated appropriately. The term "tanks" has been added to containers other than drums to clarify how tanks should be evaluated. Also, equations for calculating hazardous waste quantity based on area have been revised based on a study of waste sites. The study indicated that new depth assumptions should be used for some sources; the land treatment equation was revised based on data from the same study about typical loading rates in land treatment operations.

Section 2.4.2.1.2 Hazardous wastestream quantity. Explains how to assign a value for hazardous wastestream quantity based on the mass of the wastestream. An explanation of the treatment of RCRA hazardous wastes has been added to clarify the scoring of these wastes.

Section 2.4.2.1.3 Volume. Explains how to assign a value for source volume.

Section 2.4.2.1.4 Area. Explains how to assign a value for source area.

Section 2.4.2.1.5 Calculation of source hazardous waste quantity value. Explains how to assign a value to source hazardous waste quantity.

Section 2.4.2.2 Calculation of hazardous waste quantity factor value. Explains how to assign a factor value to hazardous waste quantity using Table 2-6. The values in Table 2-6 include several changes. The cap applied to the factor value (i.e., the lowest hazardous waste quantity value required to assign the maximum factor value) has been increased to reflect more accurately the range of hazardous substance quantities found at waste sites. The cap is set based on the maximum quantity found at current NPL sites. Rather than being assigned a maximum of 100, as in the

proposed rule, the assigned factor values range to 1,000,000. Each factor value less than the cap is assigned for quantities that range across two orders of magnitude. The two-order-of-magnitude ranges reflect the uncertainty in estimates of both quantity and concentration of the hazardous substances in sources and associated releases as well as uncertainty in identifying all sources and associated releases. Using the ranges also simplifies documentation requirements. Non-zero values below 1 are rounded to 1 to ensure that sites with small amounts of hazardous substances will receive a non-zero score for waste characteristics. When hazardous constituent quantity data are incomplete, the minimum hazardous waste quantity factor value is 10, except for: (1) Migration pathways that have any target subject to Level I or II concentrations; and (2) migration pathways where there has been a removal action and the hazardous waste quantity factor value would be 100 or greater without consideration of the removal action. In these cases, the minimum hazardous waste quantity factor value has been changed to 100 (see sections III C and III Q above for further discussion of the new minimum values).

Section 2.4.3 Waste characteristics factor category value. Explains how to assign a value to the waste characteristics factor category. As discussed above, the final waste characteristics factor value is capped at 100 (1,000 with bioaccumulation potential). Values are assigned by placing the product of the waste characteristics factors into ranges of one order of magnitude, to a cap of 10^8 (10^{12} if bioaccumulation potential is considered).

Section 2.4.3.1 Factor category value. Explains how to use Table 2-7 to assign a value to waste characteristics when bioaccumulation (or ecosystem bioaccumulation) potential is not considered.

Section 2.4.3.2 Factor category value, considering bioaccumulation potential. Explains how to use Table 2-7 to assign a value to waste characteristics when bioaccumulation (or ecosystem bioaccumulation) potential is considered.

Section 2.5 Targets. Explains how targets factors are evaluated. This approach generally involves three levels of evaluation (Level I, Level II, and Potential) and the use of media-specific concentration benchmarks, as discussed in section III H of this preamble. Level III has been dropped; use of benchmarks has been extended to all pathways and

to factors that assign values to the nearest individual (well/intake). Also discusses assigning level based on direct observation and describes when tissue samples that do not establish actual contamination may be used in comparisons to benchmarks.

Section 2.5.1 Determination of level of actual contamination at a sampling location. Explains the approach used for evaluating the level of actual contamination at a sampling location; changes have been made to allow the level of actual contamination in the human food chain threat to be based on tissue samples from aquatic food chain organisms that cannot be used to establish an observed release.

Section 2.5.2 Comparison to benchmarks. Lists benchmarks and explains how to determine whether benchmarks have been equalled or exceeded (see section III H of this preamble); changes have been made to allow the level of actual contamination in the human food chain threat to be based on tissue samples from aquatic food chain organisms that cannot be used to establish an observed release.

Section 3 Ground Water Migration Pathway

The ground water migration pathway evaluates threats resulting from releases or potential releases of hazardous substances to aquifers. The major changes specific only to this pathway include replacement of the depth to aquifer/hydraulic conductivity and sorptive capacity factors with travel time and depth to aquifer factors; a revised approach for assigning mobility values; removal of the ground water use factors and their replacement by a resources factor; evaluation of the nearest well factor based on benchmarks; and revisions to scoring of sites having both karst and non-karst aquifers present.

Section 3.0 Ground Water Migration Pathway. Descriptive text has been removed. Figure 3-1 has been revised to reflect revisions to the factors evaluated, and Table 3-1 has been revised to reflect the new factor category values throughout.

Section 3.0.1 General considerations. The title has been changed.

Section 3.0.1.1 Ground water target distance limit. An explanation of the treatment of contaminated ground water plumes with no identified source has been added. For these plumes, measurement of the target distance limit begins at the center of the area of observed ground water contamination;

the center is determined based on available data.

Section 3.0.1.2 Aquifer boundaries. Descriptive text has been removed.

Section 3.0.1.2.1 Aquifer interconnections. Descriptive text has been removed as have examples of information useful for identifying aquifer interconnections.

Section 3.0.1.2.2 Aquifer discontinuities. Descriptive text has been removed.

Section 3.0.1.3 Karst aquifer. Descriptive text has been removed, and references to factors have been revised to reflect changes in factors. Text was added to clarify that karst aquifers underlying any portion of the sources at a site are given special consideration.

Section 3.1 Likelihood of release. Descriptive text has been removed.

Section 3.1.1 Observed release. Description of the criteria for establishing an observed release has been revised as discussed in Section III G of this preamble.

Section 3.1.2 Potential to release. Text has been revised to reflect changes in the factors evaluated and to clarify that karst aquifers underlying any portion of the sources at a site are given special consideration in evaluating depth to aquifer and travel time.

Section 3.1.2.1 Containment. Explanatory text has been removed and the ground water containment table is referenced. Only sources that meet the minimum size requirement (i.e., that have a source hazardous waste quantity value of 0.5 or higher) are used in assigning containment factor values. This requirement has been added to ensure that very small, uncontaminated sources do not unduly influence the score. For example, a site might have a large, but highly contained source and a very small, uncontaminated source; without a minimum size requirement, potential to release could be assigned the maximum value based on the very small source, which could overestimate the potential hazard posed by the site. If no source meets the minimum size requirement, the highest ground water containment factor value assigned to the sources at the site is used as the factor value. Table 3-2—Containment Factor Values for Ground Water Migration Pathway, has been simplified by combining repetitious items and has been moved from an attachment to the proposed rule into the body of the rule.

Section 3.1.2.2 Net precipitation. A new map has been added as Figure 3-2 to assign net precipitation factor values. The equation for calculating monthly potential evapotranspiration was clarified. Descriptive text has been removed.

Section 3.1.2.3 Depth to aquifer. As described in section III L of this preamble, the depth to aquifer factor has replaced the sorptive capacity factor and is no longer combined in a matrix with hydraulic conductivity for scoring. Table 3-5 is new and provides the factor values. The depth to aquifer factor reflects the geochemical retardation capacity of the subsurface materials, which generally increases as the depth increases. Depth to aquifer factor values are assigned to three depth ranges. Clarifying language was added related to karst aquifers.

Section 3.1.2.4 Travel time. As discussed in section III L of this preamble, this factor replaces the depth to aquifer/hydraulic conductivity factor and is based on the least conductive layer(s) rather than on the conductivities of all layers between the hazardous substances and the aquifer. Table 3-7 has been revised to reflect these changes. Table 3-5 from the proposed rule has been renumbered as Table 3-6. Text on how to obtain information to score this factor has been removed. Clarifying language was added related to karst aquifers.

Section 3.1.2.5 Calculation of potential to release factor value. Text has been revised to reflect new factor names.

Section 3.1.3 Calculation of likelihood of release factor category value. New maximum value of 550 based on observed release has been added.

Section 3.2 Waste characteristics. Descriptive text has been removed.

Section 3.2.1 Toxicity/mobility. Descriptive text has been removed.

Section 3.2.1.1 Toxicity. References § 2.4.1.1.

Section 3.2.1.2 Mobility. As discussed in sections III F and III P of this preamble, the method for assigning mobility values to hazardous substances has been revised. Table 3-8 has been revised. Mobility values are now linear rather than categorical place holders and are assigned in a matrix combining water solubility and distribution coefficients. Mobility values may now vary by aquifer for a specific hazardous substance. The maximum mobility value is no longer assigned based on observed release by direct observation. A factor value of 0 is no longer assigned for mobility, as had been the case under the proposed rule, where categorical placeholder values were used; because mobility is now multiplied by toxicity and hazardous waste quantity, assigning a 0 value would result in a pathway score of 0. This result could understate the risk posed by a site with a large volume of highly toxic hazardous

substances with low mobility. Furthermore, given the uncertainties about estimates of mobility in ground water and their applicability in site-specific situations, EPA determined that a 0 value should not be assigned to the mobility factor under any conditions.

Section 3.2.1.3 Calculation of toxicity/mobility factor value. Text has been simplified. Table 3-9 (proposed rule Table 3-10), the matrix for assigning factor values, has been revised to reflect the linear nature of the assigned values. Values for a specific hazardous substance may now vary by aquifer.

Section 3.2.2 Hazardous waste quantity. References § 2.4.2.

Section 3.2.3 Calculation of waste characteristics factor category value. Text has been revised to indicate the multiplication of the factors, the new maximum value, and the table used to assign the factor category value.

Section 3.3 Targets. Text has been revised to reflect the new names for factors. Descriptive text has been removed. Table 3-10 (Table 3-12 in the proposed rule) has been modified to list the revised benchmarks in this pathway.

Section 3.3.1 Nearest well. Title has been changed from maximally exposed individual. Text has been added to explain how to evaluate nearest wells with documented contamination (at Level I and II) and those potentially contaminated. Text was added to assign Level II contamination to any drinking water well where an observed release was established by direct observation. This section also explains how to evaluate wells drawing from karst aquifers. Table 3-11 has been renamed and the factor values have been changed. See section III B of this preamble for a discussion of the changes to assigned values for this factor.

Section 3.3.2 Population. As discussed in section III H, population is evaluated using health-based benchmarks for drinking water. For populations potentially exposed, population ranges are used to evaluate the factor. This section explains whom to count for population. Populations served by wells whose water is blended with that from other drinking water sources are to be apportioned based on the well's relative contribution to the total blended system. The rule includes instructions on the type of data to use when determining relative contributions of wells and intakes. This change is intended to reflect more accurately the exposure to populations through blended systems. The rule also includes instructions on how to apportion population for systems with standby wells or standby surface water intakes.

Section 3.3.2.1 Level of contamination. Explains how to evaluate population based on concentrations of hazardous substances in samples. Text was added to assign Level II contamination to any drinking water wells where there is an observed release by direct observation.

Section 3.3.2.2 Level I concentrations. Explains how to evaluate populations exposed to Level I concentrations. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 3.3.2.3 Level II concentrations. Explains how to evaluate populations exposed to Level II concentrations. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 3.3.2.4 Potential contamination. Explains how to assign values to populations potentially exposed to contamination from the site. The formula for calculating population values has been modified to reflect both the revised method for evaluating karst aquifers (see below) and the use of distance-weighted population values from Table 3-12, which has been added to assign distance-weighted values for populations in each distance category. The values are determined for each distance category and are then added across distance categories, and the sum is divided by 10 to derive the factor value for potentially contaminated population. The assigned values in Table 3-12 were determined by statistical simulation to yield the same population value, on average, as the use of the formulas in the proposed rule. The use of range values has been adopted as part of the simplification discussed in section III A. The rounding rules have also changed. The method for evaluating karst aquifers has been simplified and is explained in this section. Table 3-14 in the proposed rule, which included dilution weighting factors for the general case and for two special cases, has been removed, and the two special karst cases are no longer evaluated. (The generally applicable dilution factors for karst have not changed and are all incorporated into the distance-weighted population values in Table 3-12.) The scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 3.3.2.5 Calculation of population factor value. Has been revised to reflect the changes in the evaluation of actually contaminated wells. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 3.3.3 Resources. Describes how points are assigned to resource uses of ground water. Points may be

assigned if there are no drinking water wells within the target distance limit, but the water is usable for drinking water. This scoring allows for consideration of potential future uses of the aquifers. (See section III I of this preamble for a discussion of the relative weighting of these factors.)

Section 3.3.4 Wellhead protection area. Explains how to assign values to this factor. The maximum value is assigned when a source or an observed release lies partially or fully within a wellhead protection area applicable to the aquifer being evaluated, and this value has been changed from 50 to 20 to adjust for scale changes. A new criterion for scoring this factor has been added. If a wellhead protection area applicable to the aquifer being evaluated is within the target distance limit and neither of the other conditions is met, a value of five is assigned. This change allows the HRS to place a value on the resource.

Section 3.3.5 Calculation of targets factor category value. Has been revised to reflect changes in the factor names. The rounding rule has been changed, and the scoring cap was eliminated.

Section 3.4 Ground water migration score for an aquifer. Text has been revised to reflect the new divisor for normalizing pathway scores.

Section 3.5 Calculation of ground water migration pathway score. Text has been simplified.

In addition to the above noted changes, the sorptive capacity factor has been eliminated and replaced by the depth to aquifer factor, as have the tables used to assign values to this factor (Tables 3-6 and 3-7 in the proposed rule). The ground water use factors have also been eliminated as have the tables used to assign their values (Tables 3-15 and 3-16 in the proposed rule). Figures 3-2, 3-3, and 3-4 and Tables 3-4, 3-8, 3-9, 3-13 of the proposed rule have been removed.

Section 4 Surface Water Migration Pathway

The surface water migration pathway evaluates threats resulting from releases or potential releases of hazardous substances to surface water bodies. One major change to this pathway is the addition of a new component for scoring ground water discharge to surface water; either this component or the overland flow/flood migration component or both may be scored. For each component, three threats are evaluated: drinking water threat, human food chain threat, and environmental threat. Other major changes specific to this pathway include elimination of the recreational use threat; simplification of

overland flow potential to release factors; modifications to the human food chain threat including addition of a food chain individual; modifications to the treatment of bioaccumulation potential and addition of a similar factor, ecosystem bioaccumulation potential, to the evaluation of the environmental threat; modifications to the persistence factor; revisions to the dilution weights; additions of benchmarks, extension of benchmarks to evaluation of the nearest intake, and addition of levels of contamination to the human food chain targets; modifications to criteria for establishing actual food chain contamination; elimination of the surface water use factor; addition of a resources factor to the targets evaluation in the drinking water threat; and revisions to sensitive environments.

Section 4.0 Surface Water Migration Pathway. New structure of the pathway is explained. Descriptive text has been removed. Figure 4-1 has been revised to reflect revisions to the factors evaluated, and Table 4-1 has been revised to reflect the new factor category values throughout.

Section 4.0.1 Migration components. Explains how to score the two migration components.

Section 4.0.2 Surface water categories. A definition of coastal tidal waters has been added. Some surface water bodies that belong in this new category were listed in other categories in the proposed rule (e.g., bays and wetlands contiguous with oceans). Isolated perennial wetlands have been added to the definition of lakes; salt water harbors largely protected by seawalls have been removed from the definition of lakes. Ocean has been defined more precisely as areas seaward from the baseline of the Territorial Sea. Contiguous bays have been removed from, and wetlands contiguous to the Great Lakes have been added to ocean and ocean-like bodies. These definitional changes/clarifications more accurately reflect the different characteristics of the water bodies.

Section 4.1 Overland flow/flood migration component. As discussed in section III M of this preamble, the surface water migration pathway has been divided into two components. The overland flow/flood component is essentially the surface water migration pathway as proposed except that the recreational use threat has been eliminated.

Section 4.1.1 General considerations. Consists of several subsections.

Section 4.1.1.1 Definition of the hazardous substance migration path for overland flow/flood migration component. Text has been simplified.

Section 4.1.1.2 Target distance limit. Explains target distance limits for sites in general and adds an explanation of how to calculate the target distance limit for contaminated sediments with no identified source. For these latter sources only, when there is a clearly defined direction of flow, the target distance limit is measured beginning at the observed sediment contamination farthest upstream; when there is no clearly defined direction of flow, the target distance limit is measured from the center of the area of observed sediment contamination. Discusses the determination of whether surface water targets are subject to actual or potential contamination. Also, text was added to assign Level II to targets subject to actual contamination based on direct observation.

Section 4.1.1.3 Evaluation of the overland flow/flood migration component. Explains that for multiple watersheds, highest score assigned to a watershed is used instead of summing watershed scores as proposed.

Section 4.1.2 Drinking water threat. Descriptive text has been removed.

Section 4.1.2.1 Drinking water threat—likelihood of release. Text has been simplified to clarify when potential to release factors need to be evaluated.

Section 4.1.2.1.1 Observed release. Text has been revised to reflect the changed maximum value.

Section 4.1.2.1.2 Potential to release. Text has been revised to reflect the changed maximum value and has been simplified.

Section 4.1.2.1.2.1 Potential to release by overland flow. Explains when overland flow potential to release is not evaluated.

Section 4.1.2.1.2.1.1 Containment. Text has been revised to reflect changes in the numbering of the containment table. Only sources that meet the minimum size requirement (i.e., that have a source hazardous waste quantity value of 0.5 or higher) are used in assigning containment values. This requirement has been added to ensure that very small, uncontained sources do not unduly influence the score. For example, a site might have a large, but highly contained source and a very small, uncontained source; without a minimum size requirement, the potential to release could be assigned the maximum value based on the very small source, which could overestimate the potential hazard posed by the site. If no source meets the minimum size requirement, the source with the highest

surface water containment factor value is used. Descriptive text has been removed. Table 4-2, Containment Factor Values for Surface Water Migration Pathway, has been simplified by combining repetitious items and has been moved from an attachment to the proposed rule into this section of the final rule.

Section 4.1.2.1.2.1.2 Runoff. Text on evaluating rainfall has been simplified by removing explanatory references. The runoff curve number has been simplified by substituting a soil group designation in its place. Table 4-4 (proposed rule Table 4-2) has been revised to list only the soil group designations. Based on analyses of runoff and actual drainage area sizes, Table 4-3 (proposed rule Table 4-3) has been revised by changing the divisions of drainage area size. Table 4-5 (proposed rule Table 4-4) has been revised to reflect the changes related to the use of soil group designations. Table 4-6 (proposed rule Table 4-5) has been revised so that the heading in the table reads Rainfall/Runoff Value; the values assigned have been adjusted on the basis of both the higher maximum value assigned to the factor category and the analyses described above. Explanatory text has been removed.

Section 4.1.2.1.2.1.3 Distance to surface water. Values assigned to distance to surface water factor values in Table 4-7 (proposed rule Table 4-6) have been revised to adjust for the higher maximum assigned to the factor category.

Section 4.1.2.1.2.1.4 Calculation of the factor value for potential to release by overland flow. Has not been changed except for assigned value.

Section 4.1.2.1.2.2 Potential to release by flood. Descriptive text has been removed.

Section 4.1.2.1.2.2.1 Containment (flood). Text in Table 4-8 (proposed rule Table 4-7) has been revised to incorporate new language on required documentation on containment. The requirement for certification by an engineer has been dropped. The new documentation requirements have been added to make the rule consistent with RCRA requirements.

Section 4.1.2.1.2.2.2 Flood frequency. Values assigned to this factor by Table 4-9 (proposed rule Table 4-8) have been revised to better reflect probabilities and to adjust for the higher maximum assigned to the factor category. Descriptive text has been removed.

Section 4.1.2.1.2.2.3 Calculation of the factor value for potential to release by flood. Has been revised to reflect a minimum size requirement for sources.

Section 4.1.2.1.2.3 Calculation of potential to release factor value. Text has been simplified, and the assigned value has been changed.

Section 4.1.2.1.3 Calculation of drinking water threat—likelihood of release factor category value. Text has been simplified. The maximum value has been changed, and the maximum for potential to release is no longer equal to the maximum for observed release.

Section 4.1.2.2 Drinking water threat—waste characteristics. Descriptive text has been removed.

Section 4.1.2.2.1 Toxicity/persistence. Editorial changes have been made.

Section 4.1.2.2.1.1 Toxicity. References § 2.4.1.1.

Section 4.1.2.2.1.2 Persistence. As discussed in section III F of this preamble, several changes have been made to this factor, including the deletion of free-radical oxidation as a decay process and the inclusion of consideration of K_{ow} to account for sorption to sediments. Table 4-10 (proposed rule Table 4-9) has been revised to change the values assigned from categorical numbers to linear scales. The divisions among the half-lives for rivers, oceans, coastal tidal waters, and Great Lakes have changed based on a study of travel time, and the text has been modified to clarify the procedure for determining whether to base the persistence factor on lakes or on rivers, oceans, coastal tidal waters, and Great Lakes. A factor value of 0 is no longer assigned for persistence, as had been the case under the proposed rule, where categorical place-holder values were used; because persistence is now multiplied by toxicity and hazardous waste quantity, assigning a 0 value would result in a pathway score of 0. This result could understate the risk posed by a site with a large volume of highly toxic hazardous substances with low persistence. Furthermore, given the uncertainties about half-life estimates and their applicability in site-specific situations, EPA determined that a 0 value should not be assigned to the persistence factor under any conditions. The text has been modified to clarify selection of an appropriate default value. Table 4-11—Persistence Values—Log K_{ow} , has been added. Descriptive text has been removed.

Section 4.1.2.2.1.3 Calculation of toxicity/persistence factor value. Table reference has been changed to reflect the change in numbering. Table 4-12 (proposed rule Table 4-10) has been changed to reflect the multiplicative relationship.

Section 4.1.2.2.2 Hazardous waste quantity. References § 2.4.2.

Section 4.1.2.2.3 Calculation of drinking water threat—waste characteristics factor category value. Text has been revised to indicate the multiplication of the factors, the new maximum value, and the table used to assign the factor category value.

Section 4.1.2.3 Drinking water threat—targets. Descriptive text has been removed. Text was added to assign Level II to actual contamination based on direct observation.

Section 4.1.2.3.1 Nearest intake. Title and the factor name have been changed. As discussed in Section III B of this preamble, this factor is now assigned values based on health-based benchmarks. Instructions for how to assign dilution weights to closed lakes and lakes with no surface flow entering have been added. Table 4-13, Surface Water Dilution Weights (proposed rule Table 4-11), has been revised to add more types of surface water bodies and to change the dilution weights. These changes have been made to reflect more accurately the flow ranges of water bodies and are based on analysis of data on flow rates and dilution.

Section 4.1.2.3.2 Population. As explained above, population is evaluated based on two levels of actual contamination. Targets potentially contaminated are dilution weighted and are assigned values based on ranges. Populations served by intakes which are blended with water from other drinking water sources are to be apportioned based on the intake's relative contribution to the total blended system. The rule includes instructions on the type of data to use when determining relative contributions of intakes and wells. This change is intended to reflect more accurately the exposure of populations through blended systems. The rule also includes instructions on how to apportion population for systems with standby wells or standby surface water intakes.

Section 4.1.2.3.2.1 Level of contamination. Explains how to evaluate population based on the level of contamination to which they are exposed.

Section 4.1.2.3.2.2 Level I concentrations. Descriptive text has been removed. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 4.1.2.3.2.3 Level II concentrations. Text has been simplified and revised to reflect the changes discussed above. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.2.3.2.4 Potential contamination. Equation used to calculate this factor has been revised as discussed above. A new table, Table 4-14, Dilution-Weighted Population Values for Potential Contamination Factor for Surface Water Migration Pathway, has been added to assign values, which are then added across different surface water body types and divided by 10 to derive the value for potentially contaminated population. The assigned values in Table 4-14 for each population range category were determined by statistical simulation to yield the same population value, on average, as the use of the formulas in the proposed rule. The use of range values has been added as part of the simplification discussed in section III A. The rounding rule has also been changed, and the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.2.3.2.5 Calculation of population factor value. Explains how to combine values assigned to the three population groups. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 4.1.2.3.3 Resources. As discussed in section III J of this preamble, this factor has been added to account for the potential impact of surface water contamination on resource uses.

Section 4.1.2.3.4 Calculation of drinking water threat—targets factor category value. Has been revised to reflect the changes in this factor category. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 4.1.2.4 Calculation of drinking water threat score for a watershed. Text has been simplified. The divisor has changed.

Section 4.1.3 Human food chain threat. Descriptive text has been removed.

Section 4.1.3.1 Human food chain threat—likelihood of release. Section references have been changed.

Section 4.1.3.2 Human food chain threat—waste characteristics. Text has been simplified.

Section 4.1.3.2.1 Toxicity/persistence/bioaccumulation. Text has been simplified and modified because of the change in the use of bioaccumulation potential in selecting the substance potentially posing the greatest hazard.

Section 4.1.3.2.1.1 Toxicity. Has been changed to reference § 2.4.1.1. Also changed so that evaluation of toxicity is not limited to substances with the highest bioaccumulation potential.

Section 4.1.3.2.1.2 Persistence. Clarifies how to evaluate persistence for

contaminated sediment sources, and adds coastal tidal waters as a category of surface water. Also changed so that evaluation of persistence is not limited to substances with the highest bioaccumulation potential.

Section 4.1.3.2.1.3 Bioaccumulation potential. As described in section III M of this preamble, the method of accounting for bioaccumulation potential in the selection of the substance potentially posing the greatest hazard has been changed. In the final rule, bioaccumulation potential is considered together with toxicity and persistence rather than as a primary selection criterion. This change was made because all three factors are now scored on linear scales. In addition, where data exist, separate bioconcentration factor values are assigned for salt water and fresh water; the text now clarifies that the higher of these values is used for fisheries in brackish water and for sites with fisheries present in both salt water and fresh water. The adjustment for biomagnification has been dropped because it tended to double count bioaccumulation. Both Table 4-15 (Table 4-14 in the proposed rule) and the text have been modified to clarify the data hierarchy for assigning bioaccumulation potential factor values. Also, Table 4-15 now makes it clear that the assigned values for bioaccumulation potential are on a linear scale.

Section 4.1.3.2.1.4 Calculation of toxicity/persistence/bioaccumulation factor value. Explains how to calculate a toxicity/persistence/bioaccumulation value. Table 4-16, Toxicity/Persistence/Bioaccumulation, has been added to assign the factor value.

Section 4.1.3.2.2 Hazardous waste quantity. References § 4.1.2.2.2.

Section 4.1.3.2.3 Calculation of human food chain threat—waste characteristics factor category value. Text has been revised to indicate the multiplication of the toxicity/persistence and hazardous waste quantity factor values, subject to a maximum, and the further multiplication of that product by the bioaccumulation potential factor value, subject to a maximum for this second product, and to reference the table for assigning the factor category value.

Section 4.1.3.3 Human food chain threat—targets. Has been revised to reflect addition of the new food chain individual and the deletion of the fishery use factor. As discussed in section III M of this preamble, criteria for establishing a fishery subject to actual contamination have been revised. Text was added to describe the additional

tissue samples that can be used to establish Level I contamination.

Section 4.1.3.3.1 Food chain individual. As discussed in section III M of this preamble, this factor is new. This section explains how to assign a value to the factor.

Section 4.1.3.3.2 Population. Has been changed as discussed in section III M of this preamble.

Section 4.1.3.3.2.1 Level I concentrations. The approach to calculating this factor value has been revised as discussed in section III M of this preamble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 4.1.3.3.2.2 Level II concentrations. Explains how to assign values as discussed in section III M of this preamble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.3.3.2.3 Potential human food chain contamination. The approach to calculating this factor value has been revised as discussed in section III M of this preamble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.3.3.2.4 Calculation of the population factor value. Text has been revised to omit the maximum. The rounding rule has been changed, and the scoring cap was eliminated.

Section 4.1.3.3.3 Calculation of human food chain threat—targets factor category value. Explains how to calculate the targets value. The rounding rule has been changed, and the scoring cap was eliminated.

Section 4.1.3.4 Calculation of human food chain threat score for a watershed. Text has been simplified. The divisor has been changed.

Section 4.1.4 Environmental threat. Descriptive text has been removed.

Section 4.1.4.1 Environmental threat—likelihood of release. Section references have been changed.

Section 4.1.4.2 Environmental threat—waste characteristics. Descriptive text has been removed.

Section 4.1.4.2.1 Ecosystem toxicity/persistence/bioaccumulation. Text has been revised to include the addition of ecosystem bioaccumulation potential as a multiplicative factor.

Section 4.1.4.2.1.1 Ecosystem toxicity. The approach for evaluating ecosystem toxicity has been revised. Additions have been made to the data hierarchy (see section III J of this preamble), and a default value of 100 was added to cover the situation where appropriate aquatic toxicity data were

unavailable for all of the substances being evaluated. Table 4-19 (proposed rule Table 4-23) has been revised to make the factor linear and to eliminate the rating category of 0 (except when data are unavailable for a given substance); these changes make the ecosystem toxicity factor more consistent with the toxicity factor in the other pathways and threats. Text was added to clarify the evaluation of ecosystem toxicity for brackish water.

Section 4.1.4.2.1.2 Persistence. Section references have been changed. Clarifies how to evaluate persistence for contaminated sediment sources, and adds coastal tidal waters as a category of surface water.

Section 4.1.4.2.1.3 Ecosystem bioaccumulation potential. As explained in section III J of this preamble, this factor is new for this threat and is evaluated similarly to (but with several key differences from) the bioaccumulation potential factor in the human food chain threat.

Section 4.1.4.2.1.4 Calculation of ecosystem toxicity/persistence/bioaccumulation factor value. Section references have been changed. Table 4-20 (proposed rule Table 4-24) has been changed to reflect the changes in the values for the factors. Table 4-21, Ecosystem Toxicity/Persistence/Bioaccumulation Values, is new and assigns values for the combined toxicity/persistence/bioaccumulation factor.

Section 4.1.4.2.2 Hazardous waste quantity. Section references have been changed.

Section 4.1.4.2.3 Calculation of environmental threat—waste characteristics factor category value. Text has been revised to indicate the multiplication of the ecosystem toxicity/persistence and hazardous waste quantity factor values, subject to a maximum, and the further multiplication of that product by the ecosystem bioaccumulation potential factor value, subject to a maximum for this second product, and to reference the table for assigning the factor category value.

Section 4.1.4.3 Environmental threat—targets. Descriptive text has been removed.

Section 4.1.4.3.1 Sensitive environments. Explains how to evaluate sensitive environments. Table 4-22, Ecological-Based Benchmarks for Hazardous Substances in Surface Water, has been revised as described in section III H of this preamble. The rounding rule has also been changed.

Section 4.1.4.3.1.1 Level I concentrations. Explains the new method of evaluating wetlands based on wetland frontage, or, in some situations,

wetland perimeter. Table 4-23, Sensitive Environments Rating Values, has been revised as discussed in section III J of this preamble. Table 4-24, Wetlands Rating Values for Surface Water Migration Pathway, has been added to assign values to wetlands based on the total length of wetlands. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 4.1.4.3.1.2 Level II concentrations. Has been revised to reflect the method of evaluating wetlands. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.4.3.1.3 Potential contamination. Has been revised to reflect the method of evaluating wetlands. The rounding rule has also been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.4.3.1.4 Calculation of environmental threat—targets factor category value. Has been revised to remove the maximum from the targets factor category. The rounding rule has also been changed.

Section 4.1.4.4 Calculation of environmental threat score for a watershed. Divisor for the threat has been changed. A cap of 60 was explicitly placed on the environmental threat score, which results in the same maximum possible threat score as in the proposed rule. (In the proposed rule, environmental threat targets were capped at 120, which resulted in an environmental threat score maximum of 60.) However, in the final rule the targets category is uncapped and can score higher than 120 to compensate for low scores in other factor categories.

Section 4.1.5 Calculation of overland flow/flood migration component score for a watershed. Explains how to calculate the score for the watershed.

Section 4.1.6 Calculation of overland flow/flood migration component score. Explains how to calculate the score for the component based on the highest watershed score (in the proposed rule watershed scores were summed).

Section 4.2 Ground water to surface water migration component. As discussed in section III M of this preamble, this component has been added to the rule to account for contamination of surface water bodies through ground water migration of hazardous substances. Thus, all sections referring to this component are new.

Section 4.2.1 General considerations.

Section 4.2.1.1 Eligible surface waters. Explains the conditions that must apply before this component is